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Studies in African Bombyliidae. VIII. On the Geroninae

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The taxonomic position of the Geroninae is discussed and it is concluded that the subfamily is closely allied to the Systropodinae and the Toxophorinae. These three taxa form a group which may warrant family status. The distribution of the Geroninae is discussed and it is concluded that the subfamily is an ancient Gondwanan taxon; the Bombyliidae of the Canary Islands are of African origin. It is shown that the wing vein previously called the radial sector, RS, is separate from the radius, R. The nomenclature of the veins recently proposed by Hamilton (1971, 1972) is adopted; in this system the radial sector is renamed the sectoral vein, S, and other changes are noted. The identity of the genotype, *G. gibbosus* (Olivier) is discussed and this species is differentiated from *corcyreus* Frey. *G. exemptus* spec. nov. is described from larvae of *Spodoptera exempta* (Walker) (Lepidoptera, Noctuidae) from Kenya and *G. hesperidum* Frey is recorded from *Amicta cabrerai* (Lepidoptera, Psychidae) from Tenerife; the pupa of each species is described. The following new species are described: *G. candidulus*, *dilutus* and *varicapillis* from Madagascar; *ablusus*, *saccharus*, *samarus* and *viaticus* from Nigeria and *juxtus* and *exemptus* from Kenya. *G. nasutus* Bezzi is recorded from Nigeria and its taxonomic position discussed. As a consequence, *Amictogeron* Hesse is relegated to the synonymy of *Geron* (*sensu stricto*) and *Pseudoamictus* Bigot reduced to the status of a subgenus. *G. hessei* nom. nov. is proposed for *Amictogeron peringueyi* Hesse *nec Geron peringueyi* Hesse and *Amictogeron phaeopterus* Hesse is synonymised with *Geron semifuscus* Séguy. The zoogeography of *G. semifuscus* and *G. umbripennis* Bezzi, from Rodrigues, and related species is discussed and it is concluded that the Mascarene Islands are not oceanic islands but a Gondwanan continental fragment.

TAXONOMIC POSITION OF THE GERONINAE

The Geroninae is one of the segregates within the Bombyliidae whose taxonomic position is uncertain. Most of the older classifications, for example that of Bezzi (1924), unite *Geron* Meigen with *Phthiria* Meigen in the subfamily Phthiriinae. Hesse (1938) erected the subfamily Geroninae to include *Geron* and two other very closely related South African genera, an arrangement accepted by most subsequent students except Painter and Painter (1965), who retained *Geron* in the Phthiriinae. Mühlenberg (1971) in a study of the female reproductive system, particularly of the structure and musculature of the egg-laying apparatus, in a small generic sample of the Mediterranean fauna, has proposed a so-called "phylogenetic" classification of the Bombyliidae in which *Geron*, in company with *Phthiria*, *Systropus* Wiedemann, *Toxophora* Meigen and *Usia* Latreille, is considered to be one of the plesiomorphous genera (and subfamilies) in contrast with the apomorphous, according to Mühlenberg,

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genera such as *Bombylius L.*, *Anthrax* Scopoli or *Villa* Lioy. However, Mühlenberg's analysis seems to be directed more towards sustaining, or confirming, the currently accepted classification, rather than a critical evaluation of that classification, and it is also unfortunate that the conclusions are based, in very large part, upon the anatomical components only of a highly adaptive oviposition mechanism, while associated behavioural aspects are ignored. The anatomy and morphology of the oviposition apparatus of, for example *Bombylius* or *Villa* may be, and very probably is, apomorphous, but it does not follow that the plesiomorphic homologue is the oviposition apparatus of *Geron* or *Systropus*. In both of these genera there are significant modifications of the genital segments which are definitely apomorphic, not the plesiomorph homologue of some other condition and which are associated with patterns of behaviour which appear to be more specialised than comparable patterns in *Bombylius* or *Villa*. The plesiomorphous and apomorphous groups of genera proposed by Mühlenberg represent, in my view, apomorphic groups of equal, or comparable, rank, each group having evolved its own oviposition mechanisms and behaviour patterns. The relationship between these various apomorphic groups is another matter.

All the current classifications of the Diptera Brachycera recognise the Bombyliidae as a discrete taxonomic unit and only Rohdendorf (1964) has challenged this concept by separating out the families Systropodidae, Usiidae and Cyrtosiidae. Although I cannot assess the merits of these proposals, they may well provide some basis for a re-classification. Far from accepting the implied view of Mühlenberg (1971), that the Bombyliidae constitute a single phyletic unit, I consider it to be largely an artificial aggregate, the main criterion being that certain flies "look like" a Bombyliid, i.e. have a greater or lesser general resemblance to *Bombylius*, or *Anthrax* or *Villa*, which are accepted as the "typical" Bombyliidae. Because it is a "dump" for those taxa which are difficult to place elsewhere, it is not surprising that debate has arisen on several occasions over the status of some of the more unusual genera and will continue to arise until some more rational basis has been devised for the classification of the Diptera now included in this family. In my view, there are at least five distinct segregates within the current concept of the family, but their nomenclature, definition and status in relation to each other and to neighbouring families such as the Therevidae, Scenopinidae and Empididae require much more research. One of the groups would include the Geroninae, Systropodidae and Toxophorinae and may warrant family rank as the Systropodidae.

The mouthparts and body form of the members of the Geroninae are adapted to habits of flower visiting and nectar feeding, which suggests that the subfamily in its present manifestation, cannot antedate the appearance of nectar-bearing angiosperms. Although entomophily is a primitive feature of Angiosperms (Takhtajan, 1969), flower visiting by the early pollinators of angiosperms was probably associated with pollen feeding. The change to pollination by insects with highly modified mouthparts, able to extract nectar concealed within a floral tube, is probably associated with the Cretaceous expansion of the Angiosperms (Takhtajan, 1969). The origin of the Geroninae, like that of some other subfamilies and genera of Bombyliidae, may therefore be dated, on present evidence and theories about Angiosperm evolution, to a period in the late Jurassic to early Cretaceous, in the middle Mesozoic. It is worth noting here that a common conception of the Bombyliidae as all, or nearly all, possessing mouthparts (and habits) adopted to specialised flower feeding is erroneous. The genera *Anthrax* and *Villa* are large taxa, two of the largest in the family, containing very many species (particularly so if genera such as *Spogostylum* Macquart or *Hemiptenthes* Löew are included as in the

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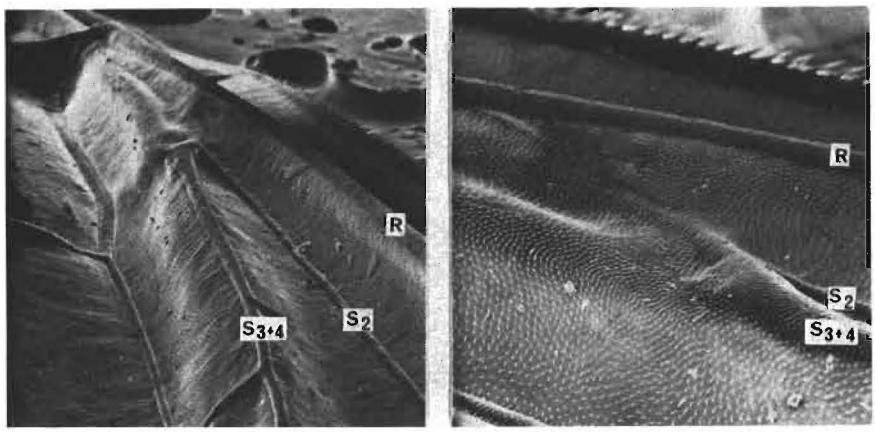
expanded concepts of *Anthrax* and *Villa* used by American authorities), yet the mouthparts of these genera are of the muscoid, labellate type. These are general feeders able to accept any available liquid or a food such as pollen, but unlikely to be able to take nectar from the tubular corollae of the types of flowers visited by bombyliids possessing mouthparts similar to those of *Geron*. Thus the type of proboscis and feeding habits of the adult indicate the earliest time of origin of *Geron* (and many other bombyliid genera) but do not provide a similar constraint for *Anthrax* and *Villa*. In relation to the earlier comments on plesiomorphous and apomorphous groups of genera, the mouthparts and feeding habits of *Geron* are apomorphous and are derivable from a muscoid type of proboscis; the opposite derivation is scarcely conceivable. However, rather than sugesting that the labellate proboscis and the feeding habits of *Anthrax* and *Villa* are the plesiomorphous conditions of those of *Geron*, within a monophyletic line, the differences are held to support the premise that *Geron* and its allies belong to a stock entirely different from genera such as *Anthrax* and *Villa*.



Figs 1–2. Wing of *Geron nasutus*. (Examined with Cambridge "Stereoscan" MK 2A, after plating with 30 nm gold. Photographs, Roger Turner). 1. Oblique view of base of "RS" stem of sectoral vein, showing convex fold from fork of S to arculus. x 57. 2. Base of "RS" = base of sectoral fork. The connection between R and S, the supposed RS, is not a vein but a secondary thickening of the membrane; this is also shown in fig. 1. x 118.

In the wing venation of *Geron*, the radial sector, RS (prefurca), is at best only tenuously connected to R1 and has a more or less pronounced elbow, particularly well shown in *G. snowi*, (fig. 4), where RS fades out before reaching R1 and a prominent elbow is present from which a distinct dark stain follows a concave wing fold back to the arculus. *G. nasutus* is very similar, but the stain between RS and the arculus is absent. Figures 1 and 2 are electron scan photographs of the base of RS in *nasutus*, and show that RS is virtually non-existent proximal to the fork R 2+3—R 4+5 and that the continuation basad of RS appears to be along the concave fold to the arculus, suggesting that the section of RS between R1 and the radial fork is a secondary development and

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therefore, that the veins now called R2+3 and R4+5 are not in fact branches of R but are of a quite separate origin. Vignon and Séguy (1929a, b) and Séguy (1959) have suggested that RS and its branches are the anterior branch, MA, of the media, M. While this interpretation does acknowledge that RS and its branches are distinct from the radius it leads to difficulty in the interpretation and nomenclature of other veins in the radio-medial field. Hamilton (1971, 1972a, b, c) has analysed wing venation throughout the Insecta and shows that what has been called the radius-sector is primitively a dichotomous vein, which he names the sector vein, independent of the unbranched radius proper. In this interpretation the veins hitherto known in the Diptera as RS and R2 to R5 become the sector, S, and its branches S1 to S4 and the r-m cross vein becomes crossvein s-m. Hamilton's interpretation resolves the difficulties of the Vignon-Séguy interpretation and I am therefore adopting it for this and all future papers. It is shown in fig. 4 as applied to *Geron*. The fork S3–S4, which has been called the cubital fork, I shall refer to as the *sectoral fork*; the anal cell as the *empusal cell* and the axillary lobe as the *anal lobe*. The wing venation of the Geroninae is characterised by the costa ending at the empusal vein, the absence of M2 and the closed and stalked empusal cell, Cu2 and E fusing at some distance from the wing margin. There is also a distinct wing stigma and the costa is more or less strongly arched outwards between the humeral cross-vein and the end of Sc. In many species of *Geron*, S1 is still more or less evident and in others, such as *G. snowi*, the original line of the base of S is marked by a more or less distinct stain in the wing membrane. The venational characters of the Geroninae are also found in the Systropodinae and Toxophorinae and form a constant and easy separation from all other Bombyliidae.

Species of *Geron* have been bred from larvae of Pyralididae in Europe (Mik, 1896) and West Africa (Descamps 1956, who records an unidentified species from a stem borer of rice), from Psychidae in Europe (Mik, 1896) and North America (Donahue, 1967) and Tineidae in India (Maxwell-Lefroy, 1909). No descriptions of any of the immature stages have been published, but I now report 2 more host records and describe the pupa for two species.

In both *G. exemptus* and *hesperidum*, the pupa lacks the pre-oral ventral prominences of most other bombyliid pupae. Pupae of both the Systropodinae and the Toxophorinae also lack these prominences, a similarity in an immature stage which further distinguishes these three subfamilies from other Bombyliidae.

DISTRIBUTION OF THE GERONINAE

The Geroninae is a widely distributed subfamily, found in all faunal regions, although absent from the northern parts of the Palaearctic and Nearctic Regions, and with its centre of diversity apparently in Africa. There is a very uneven distribution of species between Regions, partly because separation of species is difficult and many have been incorrectly synonymised with others still unrecognised, but also and perhaps more importantly, because of lack of study in most parts of the world. Africa south of the Sahara has about 60 species, and of these 50 or so occur in southern Africa, a disparity which is the direct result of the intensive collecting there compared with the rest of the continent. The North African – Southern Palaearctic fauna (the Palaearctic fauna being of African origin) contains possibly 15 or 20 species, an uncertainty which is referred to again. There are at present only two species recorded from the Oriental Region, although several very interesting species are undescribed, and there are five

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species known from Australasia, but this is many fewer than actually exist, since the continental Australian fauna is virtually unknown. In North America, 22 species are listed in two subgenera; there are three or four species known from Central America and the West Indies but only two are recorded from the whole of South America, one from "Amazonia", the other from Chile. Future collecting may alter the present dominance of Africa in the distribution of the subfamily (although apart from the south that continent is itself poorly collected) but it is unlikely to change the inference that the Geroninae is a Gondwanan taxon. It is, essentially, a monogeneric subfamily and its occurrence as a single, readily recognisable and easily defined genus in all Regions and in islands such as Madagascar, Rodrigues and the Bismarck group suggests a remarkable stability over a very long period.

Hesse (1938) recognised 3 genera in southern Africa, *Geron* itself and the apparent endemics *Pseudoamictus* Bigot and *Amictogeron* Hesse. The characters distinguishing these two genera from *Geron* are rather subtle, of the "more than—less than" category, except that the male genitalia have very characteristic processes arising from the basimeres. Hesse (1938) said that "*Amictogeron* constitutes a bridging or transitional genus between *Geron* and *Pseudoamictus*" and also considered that *Pseudoamictus luctuosus* Bezzi was a species that could equally well be put into *Amictogeron*. Bezzi (1924) thought that *G. nasutus* Bezzi was closely related to *barbatus* Bezzi, a species placed by Hesse in *Amictogeron*, but Hesse, without having seen a male of *nasutus*, retained that species in *Geron*, although as a rather isolated species. The male genitalia of *nasutus* are in fact very similar to those of species of *Amictogeron* and *Pseudoamictus* and this character, together with others noted later, suggests that *nasutus* links *Geron* and *Amictogeron* as *luctuosus* connects *Amictogeron* and *Pseudoamictus*.

Bowden (1971) described 2 species from the Bismarck Islands which have several of the characters of *Amictogeron*, but with male genitalia most similar to *Geron* itself. Two Oriental species, one from Malaya, the other from Sarawak, which will be described elsewhere, also overlap the limits of *Geron* and *Amictogeron* and also have a striking dimidiate wing infuscation very similar to the Australian *G. nigralis* Roberts. When, within a regional fauna, it is almost a matter of choice to which genus some species are allocated and, in faunas of other regions, species exist which blur, or erode, supposed generic limits, one cannot retain separate genera and even subgenera become of doubtful validity. There are no grounds for retaining *Amictogeron* and I therefore propose to sink it as a synonym of *Geron* and to reduce *Pseudoamictus*, which is more easily recognised and defined than *Amictogeron*, to the status of a subgenus. I recognise 3 subgenera:

Geron (*Sensu Stricto*), type species *gibbosus* Olivier (see below);
= *Amictogeron* Hesse, **syn. nov.** Distributed in all faunal regions.
Pseudoamictus Bigot, type species *heteropterus* Wiedemann; syn.,
Pseudempis Bezzi. Distribution: S.W. Cape, Namaqualand, Botswana.
Empidigeron Painter, type species *snowi* Painter (figs 3–5). Distribution: Nearctic.

Empidigeron is, in many of its features, a development from *Pseudoamictus*; it is distinguished from the other subgenera by its prominent, hairy face and distinctly pubescent third antennal segment (fig. 3), the absence of broad, flattened scales on the body and the characteristic male genitalia (fig. 5). The wing venation (fig. 4) is like that of *Pseudoamictus* and is discussed further below.

In Africa between the mediterranean coastal strip and the Cunene-Limpopo line, the northern limit of the region considered by Hesse, only 9 or 10 species have been recorded, including 3 island species—*umbripennis* Bezzi from Rodrigues; *priapeus* Bezzi

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and *phallophorus* Bezzi from Cape Verde Islands—and unnamed species from Nigeria (Hesse, 1938) and Cameroun (Descamps, 1956). As Hesse has shown, records from Africa south of the Sahara of the Mediterranean *gibbosus* Oliv. (= *hybridus* Meigen) are erroneous and records of it from for example Ethiopia and Aldabra refer to some other, probably undescribed, species. Excluding those species previously referred to *Amictogeron*, the southern African species fall into 2 well defined groups. One has genae, metathoracic epimeron (metapleural plate of Hesse) and base of abdomen all dark and a fronto-facial tuft composed largely of hairs; the other, larger group has ivory-coloured or yellowish genae, yellowish to brownish epimeron and base of abdomen, and a fronto-facial tuft, often large and prominent, composed of scales with few or no hairs. The northern *gibbosus*, with pale genae but black epimeron and base of abdomen, and a dense, mainly scaly fronto-facial tuft, combines characters of both southern groups, and other northern species, although variable in the size of the fronto-facial tuft, also have the *gibbosus* combination of characters. Most of the species described in this paper are referable to the southern group with pale genae and epimeron, as are the Cape Verde species *priapeus* and *phallophorus*. On the other hand, *hesperidum* Frey, from the Canary Islands, and *intonsus* Bezzi from the eastern Mediterranean, seem to relate to the southern species with dark genae and epimeron and hairy fronto-facial tuft. A species from Nigeria has yet another combination, genae as well as epimeron dark but a large, scaly fronto-facial tuft and seems to be a West African outlier of the *gibbosus* group. This group has an interesting distribution; there are several species around the Mediterranean and *simplicipennis* Greathead and three new species from Madagascar also belong to it. This distribution is almost identical to that of a group of species of *Bombylisoma* Rondani and to that of *Dischistus* Loew, although this genus does not occur in Madagascar.

Geron is thus another example of the faunal continuity of the African continent and it confirms the African derivation of the fauna of the Canary Islands, previously commented on in relation to *Dischistus* (Bowden, 1973). The Bombyliidae of these Islands are almost exclusively African in ancestry, the sole possible exception being a species of *Anthrax*, the correct identity of which has not been established but which seems to be close to the Palaearctic *A. anthrax* Scopoli, a species which does not appear to have close relatives in Africa south of the Sahara. All the other apparent connections between the Bombyliidae of the Canaries and southern Europe are between species whose common derivation is African, as for instance species of *Thyridanthrax* O.S. and *Petrorossia* Bezzi, while *Lomatia brunnipennis* Macquart is much more closely allied to *Lomatia* from south of the Sahara than to Mediterranean species.

Although not certainly known from Africa, it has been necessary to establish the correct identity of *G. gibbosus* Olivier, the type species of the genus, because of considerable confusion concerning it and because what seem to be closely related species occur in eastern Africa and in Madagascar. Future work may establish more extensive connections between the faunas of the Mediterranean and Africa south of the Sahara, but in this paper links are established with Eritraea and with Madagascar. The genus has not previously been reported from this island; three species are now described.

DESCRIPTIONS

Geron gibbosus Olivier, fig. 6.

Bombylius gibbosus Olivier 1789: 329, 21.
Bombylius hybridus Meigen 1804: 186, 17.

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Geron gibbosus Meigen 1820: 223, 1, pl. 18, figs 16–19. (arbitrary change of name for *hybridus* Meigen)

There is much confusion, both taxonomic and nomenclatural, in the literature on the North African and South Palaearctic species of *Geron* and, unfortunately, some of the worst concerns the type species of the genus and subfamily. There is no apparent reason for the change of name by Meigen from *hybridus*, in 1804, to *gibbosus* in 1820; the type of the latter, and therefore also of *hybridus*, is in the Museum National d'Histoire Naturelle, Paris. It is a much denuded female, labelled "gibbosus" in Meigen's hand writing and represents a species with pale genae; all black epimeron and base of abdomen; fronto-facial tuft large, composed mostly of scales; very dark legs, the tibiae being only slightly paler than the femora; what remains of the pubescence is all frosty white. The evidence on which *hybridus* Mg. was synonymised with *gibbosus* Oliv. is, to say the least, slender, as the brief descriptions concerned can be made to fit any one of several species, but Olivier's type is lost (in fact none of Olivier's types have been found—L. Matile, personal communication), so to preserve stability of nomenclature it seems best to retain the accepted synoymy and use Olivier's name.

However, I have seen no specimens, other than Meigen's type, which can be unequivocally allocated to *gibbosus*. The species is recorded in various standard texts (for example, Engel, 1933; Paramonov, 1929; Efflatoun, 1945; Zaitsev, 1966) from all around the Mediterranean and the Near and Middle East, either as *gibbosus*, with which is synonymised *olivieri* Macquart, or as the varieties *halteralis* Wied. ap Mg., type locality Portugal, and *erythropus* Bezzi, type locality Egypt. Engel (1933: 131, fig. 64) illustrated, not very well, the male genitalia of "*gibbosus*", which differ from the genitalia of "*gibbosus*" illustrated by Frey (1937), Hesse (1938) and Zaitsev (1966), these three authors evidently having studied specimens of the same species, which was not the same as Engel's "*gibbosus*". I have seen specimens of at least 3 species identified as *gibbosus*, including both *gibbosus sensu* Engle and *gibbosus sensu* Frey, Hesse and Zaitsev. The genitalia of the latter are the same as those of a male from Ankara, Turkey, illustrated in fig. 6, so that this species has a wide distribution around the eastern Mediterranean (Turkey; Greece–Frey; Haifa, Israel–Hesse) and the middle east (Transcaucasia–Zaitsev), suggesting that the *gibbosus* of Efflatoun may be the same species and also *olivieri*, which was described from the Greek Islands.

A female, also from Ankara, which I consider to be of the same species as the Ankara male, is exceedingly like the type of *gibbosus*, but the condition of the latter is not good enough to be certain of the co-specificity of females so widely separated geographically. The question cannot be finally settled until material from France and intervening localities can be studied, but if, as seems likely, the eastern species is the true *gibbosus*, then it will almost certainly be an African species, occurring at any rate in Egypt.

Geron corcyreus Frey, fig. 7.

Geron corcyreus Frey, 1937: 48, pl. 8, figs 69, 70.

This species was described from Corsica and differentiated from *gibbosus sensu* Frey by the structure of the male genitalia. It is, judging from the illustrations, the same species as that of which Engel figured the genitalia and it appears to be the common species in France. I have seen specimens from several localities in southern France; the genitalia shown in fig. 7 are those of a male from Bas-du-Rhone. The species is

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immediately distinguished from *gibbosus* by having yellowish or yellowish brown tibiae and apices of tibiae broadly yellowish-brown. It belongs to the *gibbosus* group as it has pale genae, black epimeron and fronto-facial tuft large and scaly. At present, *corcyreus* is known from France and Corsica only. Clearly, a revision of the whole northern fauna, which probably contains more species than at present recognised, is desirable. Meanwhile it seems advisable to retain *halteralis* and *erythropus* as separate entities.

Geron candidulus spec. nov. fig. 8

♂♀. *Body* black, genae ivory-yellowish, sometimes an obscure greyish yellow in male, hind margin of epimeron and sides of first abdominal segment slightly reddish in female, usual dense greyish dusting present, a broad patch behind vertex dusted blackish-brown, median stripe of mesonotum extending as far as wing bases, brownish-grey. *Head:* occiput with frosty white hair, that on ocellar tubercle black; fine scales on occiput pale brassy-yellow; eyes contiguous in male for a distance about 3 times length of ocellar tubercle, in female frons, at vertex, about 1½ times width of tubercle, white haired; face with white hair, scales extending from distinctly above antennae to midway down genae, more dense and tufted opposite bases of antennae, scales on head beneath scattered, white; antennae black, first two segments black haired but that basally beneath on first finer and whitish, first segment about 3 times length of second, third narrow and narrowing rapidly at apex; proboscis black, palps black, black haired. *Thorax* and *abdomen* with pubescence entirely frosty white, denser on anterior margin of mesonotum, along notopleura, on mesopleura and on venter; scattered fine, hair like pale brassy yellow scales, those across posterior margin of mesonotum and on scutellum in female slightly more intense in colour, broad scales on pleura, reflexed edges of tergites and on venter dense and gleaming white. *Legs* including coxae black; tibiae, especially first pair, more brownish yellow basally or even predominantly yellowish brown in female, middle tibiae sometimes distinctly darker than others, basal segment of all tarsi brownish to yellowish brown; coxae with long, frosty white hair and white scales, femora with dense white scales and long white hair beneath, tibiae with scattered white scales; spicules black; claws blackish, pulvilli dirty white. *Wing* clear hyaline, slightly iridescent, slightly milky at base; veins brownish, yellower basally, costa and Sc yellow; s-m at about three-quarters length of discal cell, apical vein of latter distinctly S-shaped S3 arising at a right angle and distinctly kinked before joining costa, second submarginal cell open as wide as length of last section of S4; alula slightly milky, squama milky white with ochre yellow border and long, white fringe, haltere with yellowish stem and mainly black knob.

Male genitalia (fig. 8) with basimeres relatively elongate, the unsclerotised areas large, the comb of bristles well developed; aedeagus stout, its apex blunt and slightly emarginate, aedeagal processes also relatively stout. Length of body 5,4–6,7 mm, of wing 5,7–6,8 mm, of proboscis 2,6–4,2 mm.

MATERIAL EXAMINED. 2 ♂, 5 ♀: ♂-holotype, MADAGASCAR, Tulear Pr., Sakaraha, 12.iii.1958, F. Keiser; 1 ♂, 5 ♀ paratypes, as holotype. Holotype in Naturhistoriches Museum, Basel.

This species differs from *simplicipennis* by the longer first antennal segment, entirely frosty-white pubescence, paler legs and differently coloured haltere.

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Geron dilutus spec. nov.

♂. Very similar to *candidulus*, differing as follows. Smaller. *Head* with eyes contiguous for about 4 times length of ocellar tubercle; antennae more brownish, even reddish at base of third segment, first segment about twice length of second. *Thorax* and *abdomen* with scales distinctly less dense, especially on pleura, sides of abdomen and venter. *Legs* with femora yellowish brown apically, tibiae distinctly yellower, fore and mid tarsi more yellowish brown. *Wing* not milky at base, veins all pale yellowish, apical cross vein of discal cell less S-shaped, S3 less angular near S4 and less curved towards costa; squama hyaline, slightly more opaque near margin which is yellowish white; haltere with entirely yellow knob.

Length of body 4,7 mm, of wing 4,7 mm, of proboscis 2,1 mm.

MATERIAL EXAMINED. 1 ♂, holotype, MADAGASCAR, Tulear Pr., Saint Augustin, 6m., 11–13.ii.1958, B. Stuckenberg. In the Paris Museum.

Geron varicapillis spec. nov.

♂♀. *Body* black; buccal rim ivory yellow, densely silvery dusted in male, face sometimes obscurely yellowish in middle; posterior part of epimeron, lower part of first abdominal segment and reflexed edges of tergites reddish brown in female, only reflexed edges of tergites obscurely brown in male. *Head* with pubescence on occiput pale yellowish behind vertex, elsewhere frosty white; eyes in male contiguous for about 4 times length of ocellar tubercle, frons of female at vertex twice width of ocellar tubercle; pubescence of frons and face like that of *candidulus* except that stiff hairs on upper frons in female are distinctly yellowish; antennae with entirely white hair, first segment about 2½ times length of second; proboscis and palps black. *Thorax* and *abdomen* with pubescence fairly sparse, denser across front of mesonotum and on venter, white, that on mesonotum with pale yellowish tinge, that in collar more contrastingly white; fine scales on dorsum pale brassy yellow, those more densely on pleura, sides of abdomen and venter white. *Legs* predominantly yellow; coxae, basal part of fore femora to a variable extent, or fore femora predominantly especially in male, and last three to four segments of each tarsus, black or blackish; coxae with long white hair and white scales, femora with dense white scales and long white hair beneath, tibiae with less dense white scales, spicules black, claws black, pulvilli dingy white. *Wing* milky at base and in posterior part of axillary lobe, membrane clear or only faintly milky sub-hyaline, veins brownish yellow but yellow basally, costa and Sc yellow; s–m beyond middle of discal cell, apical cross vein of latter slightly S-shaped, S3 bluntly curved from S4 and not curved into costa, second sub-marginal cell open by distinctly more than length of S4; alula milky sub-opaque, squama similar with pale yellowish edge and white fringe; haltere entirely ivory yellow.

Length of body 5,7–7,0 mm, of wing 5,7–6,2 mm, of proboscis 2,9–3,6 mm.

MATERIAL EXAMINED: 3 ♂, 2 ♀ all from MADAGASCAR. ♂-holotype Majunga Pr., Ankarafantsika, 18.iv.1958, F. Keiser; 1 ♂ paratype, Majunga Pr., Amborovy, 28.vi.1958, F. Keiser; 1 ♂, 1 ♀ paratypes, Tulear Pr., 16 km. est de Tulear, 16.iv.1948, R. Paulian; 1 ♀ paratype, Ft. Dauphin Pr., Ft. Dauphin, 24.ii.1958, F. Keiser. Holotype in the Naturhistorisches Museum, Basel.

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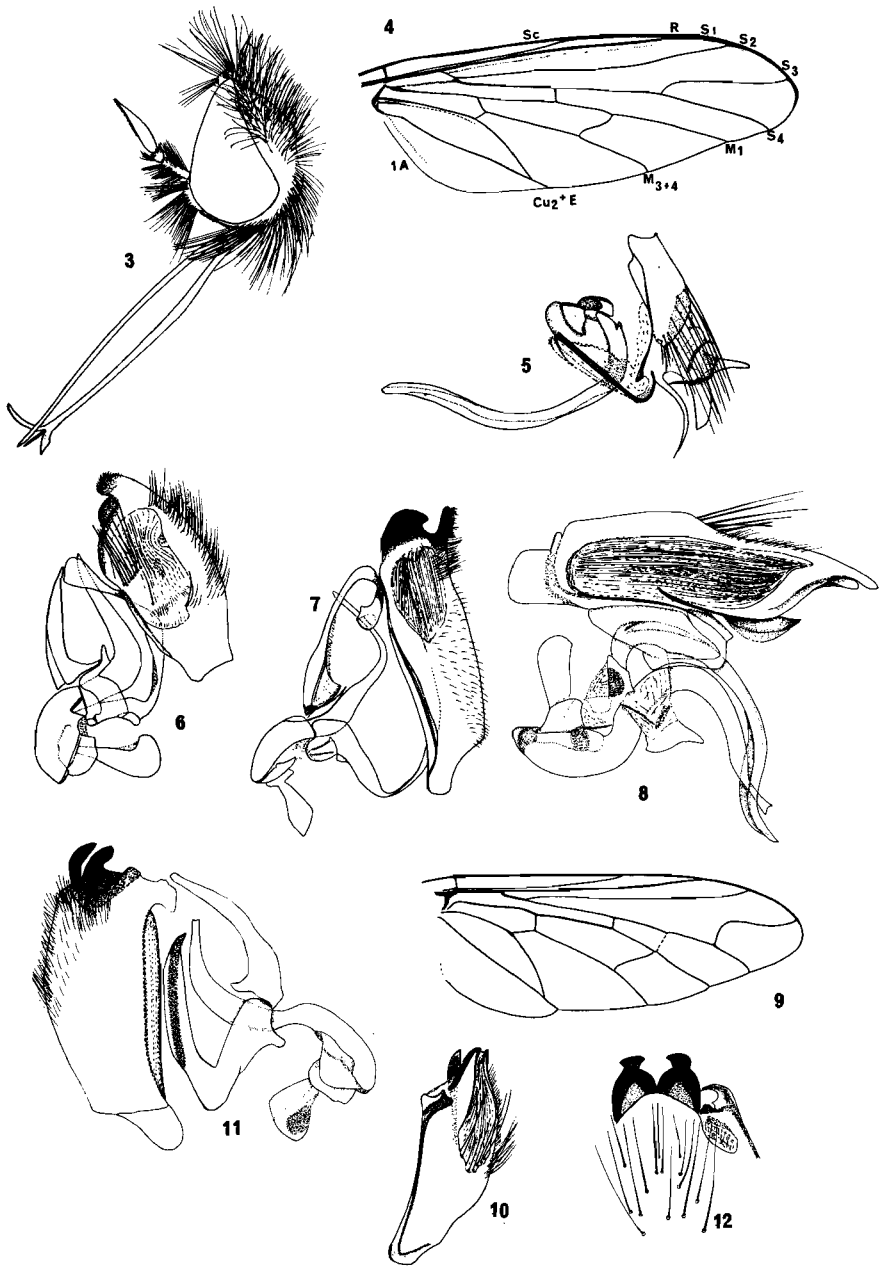

Figs 3–12. *Geron* species. 3–5. *Geron* (*Empidigeron*) *snowi*. 3. Head. 4. Wing. Sc = subcosta; R = radius; S1 — S4 = branches 1–4 of sectoral vein; M1, M3 + 4 = branches of media; Cu2 = cubitus; E = empusal vein; 1A = 1st anal vein. 5. Male genitalia. 6. *G. gibbosus*—male genitalia. 7. *G. corcyreus*—male genitalia. 8. *G. candidulus* spec. nov.—male genitalia, slightly dissociated to show aedeagal complex. 9–10. *G. viaticus* spec. nov. 9. Wing. 10. Male genitalia. 11–12. *G. exemptus* spec. nov. 11. Male genitalia. 12. Male genitalia, dorsal view of apex of basimeres.

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G. varicapillis could be considered as a species intermediate between the *gibbosus* and *perigueyi* groups, as the epimeral area and base of abdomen are quite extensively paler, especially in the female. However, this pale colour is very much less marked than is usual in the *peringueyi* group and much less extensive in the male, and for these reasons it is allied to *gibbosus*.

Geron viaticus spec. nov. figs. 9, 10.

♂. *Body* black; genae obscurely brownish yellow at middle; epimeron with extreme edge narrowly brownish, posterior margins of first three tergites at sides and of first three sternites narrowly light brownish. *Head:* occipital hair long, slightly yellowish on upper parts, white on lower parts and on head beneath, scales white, slightly yellowish on upper occiput, ocellar tubercle prominent with yellowish hair; eyes contiguous for about 3 times length of ocellar tubercle along a deeply impressed line, frontal triangle about same size as ocellar tubercle, matt black but silvery dusted when viewed from behind; fronto-facial tuft large, commencing opposite bases of antennae, of silvery white scales with only one or two hairs present, face otherwise bare; first antennal segment with white hairs, third as broad as second for about two-thirds of its length then narrowing to a short point, proportions 2,5:1:5,5; proboscis long, palps black with some pale apical hairs. *Thorax:* mesonotal hair rather short, light yellowish, notopleural and pleural hairs white; scales light brassy on mesontotum, white on pleura. *Abdomen:* hairs fairly short and sparse, very pale yellowish dorsally, white at sides and on venter; scales light brassy on matt black dorsum, at sides, on male genitalia and on venter, white, a paler yellowish, irregular band of scales at the edges of the matt area over a somewhat brownish dusted stripe between matt and grey-dusted areas. *Legs:* predominantly yellowish apart from black coxae, fore femora broadly dark brown, only apices yellowish brown, fore tarsi broadly but lightly darkened apically, mid femora somewhat darkened basally, all tarsi darkening to brownish black on last segments; all pubescence white, spicules black; claws black, pulvilli dusky. *Wing* (fig. 9) hyaline, slightly milky, iridescent, a faint yellowish stigma; veins yellowish, only slightly brownish at margin; second sub-marginal cell much broader than long at apex, s–m well beyond middle of discal cell; squama white with pale yellowish edge and white fringe; haltere pale yellowish with more creamy knob. *Male genitalia* (fig. 10) with narrow, elongate basimeres, aedeagus stout, broadly curved, rami and dorsal processes elongate, narrow, strongly curved.

MATERIAL EXAMINED: 1 ♂, holotype, NIGERIA, at roadside, mile 199 on Ilorin–Jebba road, 10.xii.1965, J. Bowden. In my collection.

This species seems to be related to the *gibbosus* group, particularly in the structure of the male genitalia and the large, scaly fronto-facial tuft. It is, however, immediately distinguished from the rest of the group by the dark genae. If *viaticus* is correctly associated with *gibbosus*, then the group is another example of the circum-Sahara distributions which unite the North African fauna with that of the rest of the continent.

Geron exemptus spec. nov. figs 11–15.

♂. *Body* black; genae ivory white, face with a narrow, median yellowish stripe expanding into a yellowish spot at apex of face; reflexed edges of first two tergites slightly brownish; grey dusting dense. *Head:* occiput with long, fine sericeous white

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hair and a fringe of darker, yellowish brown hairs along upper eye margins and behind ocellar tubercle, lower occiput and head below with shorter, sparser, more frosty white hair and scales; occellar tubercle black with erect whitish hair; eyes separated by a narrow matt black frontal stripe, about half width of anterior ocellus, for a distance about four times length of tubercle, the frontal stripe not deeply indented, frontal triangle silvery grey dusted with a white scale tuft each side and a small hair tuft; face bare, grey dusted, facialia with dense tuft of long, white hair and a small tuft of elongate, white scales on upper part; antennae black, first segment with long white hair below, shorter, slightly yellowish hair above, second with very short brownish hair above, antennal proportions 3:1:6; proboscis black. *Thorax* and *abdomen* with long, sericeous white pubescence, that on middle of mesonotum shorter and light brassy yellow; scales on pleura chalk white, fine scales on dorsum of abdomen light brassy, on sides of segment I and reflexed edges of other segments and on venter white; bristles very fine, pre-alars white, post-alars faintly and scutellars more distinctly yellowish. *Legs* (middle pair missing): coxae black, scales and hair white; fore leg with femora black, brownish yellow apically, tibiae brownish, tarsi black, base of basitarsus brownish; hind legs with femora blackish basally, apical half yellowish brown, "knee" black, tibiae yellowish brown, black apically, tarsi as first pair; hair and scales white, hind femora with anterior row of 10–12 and posterior row of 8–10 longer, erect hairs, spicules on tibiae and tarsi black; claws and pulvilli black. *Wing* clear hyaline, iridescent, very slightly yellowish at extreme base, stigma pale yellowish; veins yellowish basally gradually darkening to brownish black at wing margin; S3 at right angle to S4 with broad, angular bend and slightly curved to wing margin, s–m beyond middle of discal cell, first posterior cell, at wing margin, two thirds width of second posterior cell; basal comb white, epaulet faintly yellowish; squama white with yellowish edge and sparse white fringe; haltere clear pale yellow, base of stem with triangular blackish markings above and below. *Male genitalia* (figs 11, 12): basimeres with very heavily blackened apices, their structure difficult to see, but with a stout, apparently bifid dorsal process, apical membranous area reduced to small, dorsal incision, telomeres small, rather pointed; aedeagus stout. Length of body 6,5 mm, of wing 7,5 mm, of proboscis 3,8 mm.

MATERIAL EXAMINED: 1 ♂, holotype, KENYA, Rift Valley Province, Mt. Margaret, 14.iii.1970. E. S. Brown. In British Museum (Natural History). The reverse side of the locality label states "Pupa in A/W (army worm) outbreak area. Paras(ite) larva appeared 31.3.70, em. 12.4.70."

A second male, completely denuded, damaged and rather greasy, has almost identical genitalia and similar morphometrics and is considered to belong to the same species. The data for this male are: Kenya, Mt. Margaret, 17.iii.1970, E. S. Brown.: Pupa in A/W outbreak area. Paras. larva 18.3.70, em. 21.4.70.

This species is close to *G. psammobates* Hesse, which is known from Kenya. The most obvious differences are in the genitalia; in *exemptus* the aedeagus is shorter and stouter, the rami are stouter, the apodeme differently shaped, basimeres and telomeres very much less curved and differently shaped. Otherwise, there is obvious dark hair behind the eyes of *exemptus*, thoracic pubescence distinctly yellowish, abdominal scales more generally distributed, less evidently banded, the epimeron black, abdomen at base only narrowly pale and wing veins pale at base and towards costa whereas in *psammobates* the vein colour is the reverse.

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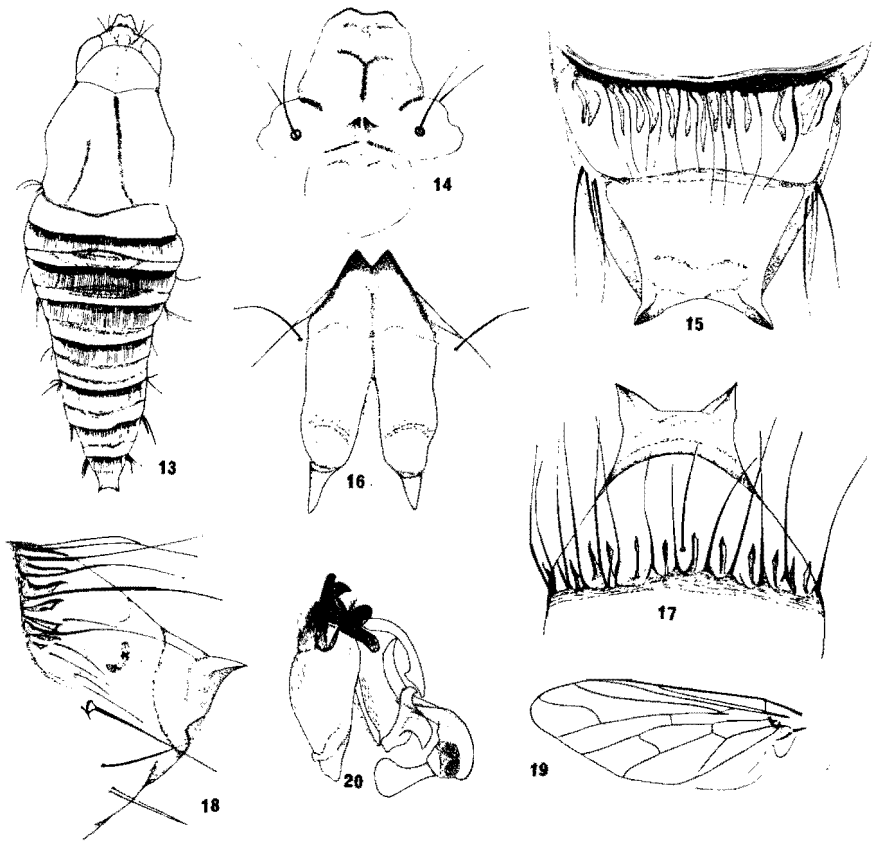

Figs 13–20. *Geron* species 13–15. *G. exemptus* spec. nov. 13. Pupa, dorsal view. 14. Pupa, dorsal view of head. 15. Pupa, dorsal view of last segments. 16–18. *G. hesperidum*. 16. Pupa, ventral view of head. 17. Pupa, dorsal view of last segments. 18. Pupa, lateral view of last segments. 19–20. *G. juxtus* spec. nov. 19. Wing. 20. Male genitalia.

The pupa, figs 13–15, is about 10,5 mm long, has a simple, rather spatulate head, the "snout" stoutly chitinised; abdominal segments with bands of stout spines and alternating long hairs, these hairs comparatively short relative to other Bombyliidae, the number of spines varying from 75–80 across second segment to 11–12 across eigth segment, the last segment with simple, paired spines; a few longer hairs around each spiracle.

Both specimens were reared from larvae of the "army worm" phase of *Spodoptera exempta* (Walker) (Lepidoptera, Noctuidae), constituting the first record of a species of *Geron* from the Noctuidae. However, it is likely that *S. exempta* is an adventive host of *G. exemptus*, its usual hosts being other Lepidoptera.

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Geron hesperidum Frey. fig 16–18.

Geron hesperidum Frey 1937: 47, figs 71–72.

This species was described from several of the Canary Islands and as Frey records over 80 specimens, seems to be common. It is a species with southern affinities, belonging to the group with black genae and epimeron and with the fronto-facial tuft of hairs only. The pubescence is mainly silky white with a yellowish flush on the mesonotum and the species seems closest to the South African *nigrifacies* Hesse. I am now recording a male from Tenerife, 9.v.1959 (no collector noted), bred from *Amicta cabrera* (Lepidoptera, Psychidae).

Pupa (figs 16–18) about 8,5 mm long, very similar to that of *exemptus* but facial prominence produced into paired, pointed processes, abdominal setae stouter, with more or less bifurcate bases, the segmental bands from which setae arise distinctly less sclerotised, abdominal spines distinctly more pointed, post-spiracular bristles more numerous and in a fan like arrangement.

Geron peringueyi Hesse.

Geron peringueyi Hesse 1938: 907, fig. 278.

This species was described from the South Karoo, south-west Cape Province and Namaqualand. The female allotype, from Cape Province, was, according to Hesse, doubtfully associated with the males. A female collected by me in western UGANDA, Busongora, Nyakatonzi, 18.v.1961, agrees with the allotype (now at the British Museum (Natural History)), so that, whether the sexes are correctly associated or not, it is certain that a South-West Cape species is also found in western Uganda.

The relegation of *Amictogeron* to the synonymy of *Geron* results in *Amictogeron peringueyi* Hesse 1938:950 becoming a junior subjective homonym of *Geron peringueyi* Hesse and for the former species I propose *Geron hessei* **nom. nov.**

Geron juxtus spec. nov. figs 19, 20.

♂. *Body* black; genae pale ivory yellowish, buccal cavity dark brown, postalar calli ferrugineous brownish, hind margins of two basal abdominal segments slightly brownish; face lightly dusted grey, pleura heavily so above a line connecting bases of front and hind coxae, lower part of sternopleuron contrastingly dull black. *Pubescence* almost entirely frosty white, that on posterior part of mesonotum with very pale sericeous yellowish gleams, the fine scales on dorsum of abdomen slightly silvery and a pale yellowish tinge on scales along the line of separation of the matt black dorsum and grey dusted sides; facial scale tuft large, dense, gleaming frosty white, the longish hairs on ocellar tubercle light brownish and a few on upper occiput light yellowish brown. *Legs* (middle pair missing): coxae and femora blackish brown to black, apices of hind femora paler, brownish, tibiae and basitarsi yellowish, other tarsal segments darkening gradually to black; hairs and scales white, spicules black; claws black, yellowish basally. *Wing* (fig. 19) slightly but distinctly milky; veins yellowish, brownish apically, s–m a little beyond middle of discal cell, S3 arising steeply from S4, then with a broadly rounded apical section curving slightly forward haltere; clear pale yellow. *Head* with eyes contiguous for a distance a little over twice length of ocellar tubercle, antennal proportions 2,4:1:6. *Male enitalia* (fig. 20) with apices of basimeres and telomeres heavilv sclerotised aedeagus

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stout and short, dorsal process short but relatively fine, ventral process short, stout. Length of body 5,0 mm of wing 5,0 mm.

MATERIAL EXAMINED: 1 ♂, holotype, KENYA, Kwali Forest, 20 miles W. of Mombasa, 1.vi.1948, Miss M. Steele. In British Museum (Natural History).

This is an interesting species, combining features of two sub-groups of South African species. On one hand, it has almost entirely black femora, black epimeron and very little ventral abdominal marking, characters which seem to place it with the *australis* Hesse sub-group, but *juxtus* has genitalia which are quite different from *australis* and its allies. The genitalia are similar to those of *peringueyi* and *psammobates* but differ from both in the shorter, stouter aedeagus. From both species *juxtus* is also readily separated by the black femora.

Geron samarus spec. nov. figs 21, 22.

♀. *Body* black; genae clear pale yellow, face medially shining brownish with a narrow, pale yellowish central stripe; katepimeron and anterior edge of first abdominal segment light biscuit colour, rest of first abdominal segment greyish, hind margin of each tergite light brownish to biscuit colour at sides, these pale margins very narrow on VI and VII, reflexed edges of first three segments fairly broadly light biscuit coloured, narrowly so on IV and V, first two sternites duller biscuit coloured; frons, a median occipital stripe and sides of occiput densely grey dusted and with broad, velvety black, undusted stripes between median and lateral grey areas of occiput, mesonotum anteriorly and laterally, a narrow prolongation from anterior border to suture, pleura and sides of abdomen with dense grey dust. *Head* (fig. 21): hair and scales on black occipital stripes light brassy, hair and scales on grey areas fading from very pale brassy near black stripes to white on lower occiput and head beneath; ocellar tubercle with short, light brassy hairs; frons at vertex barely 1½ times width of tubercle, widening to about 2½ times this width at antennae, with a broad, shallow median depression, a very narrow undusted median stripe in basal half, hairs and scales white along eye margins, those of antennal tuft extending to sides of upper face, silvery; antennae black, extreme apices of first two segments narrowly biscuit yellowish so that antennae appear to have pale joints, hairs on first two segments white, third segment broad for about two-thirds its length, then quite narrow, proportions about 2,5:1:5; proboscis long, palps short, black, pale haired. *Thorax:* mesonotum and scutellum with light brassy hairs and scales; pleura with white hairs and scales but those on upper edge of mesopleuron light brassy. *Abdomen:* dorsum with very pale brassy hairs, almost white on segment I, scales more emphatically brassy but not quite so deeply coloured as mesonotal scales, vestiture on reflexed edges of tergites and on venter white. *Legs:* mid and hind coxae obscurely but distinctly brownish, femora and tibiae all yellow except for very slight browning basally on front femora, tarsi darkening from yellow on basitarsi, first basitarsus apically brown, to black on last tarsal segments; hairs and scales, including those on coxae, white; spicules on mid and hind femora black; claws black, pulvilli whitish. *Wing* (fig. 22) vitreous hylaine, membrane between Sc and R very faintly yellowish to stigma; veins, including costa, yellowish at base darkening to brown at margin, Sc well separated from R, S2 strong, S3 gently curved at end, second sub-marginal cell short, broader than second posterior cell, s–m beyond middle of discal cell; squamae white with pale yellowish edge and long, white fringe, haltere with clear pale yellow knob and whitish stem.

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Length of body 5,5 mm, of wing 4,5 mm, of proboscis 3,0 mm.

MATERIAL EXAMINED: 1 ♀, holotype, NIGERIA, Zaria, Samaru, 29.xii.1969, J. C. Deeming. In my collection.

This species is near *peringueyi*, from which it is easily distinguished by the all-pale femora and tibiae and distinctly yellowish dorsal pubescence. From the *psammobates* section it is separated by the much shorter first antennal segment, very narrow frons and the distinctly paler face with a slight yellow macula. From *gariepinus* Hesse, *maculifacies* Hesse and *parvus* Hesse, which have a narrow frons and yellow facial macula, *samarus* is distinguished by colour of pubescence (*gariepinus*, *maculifacies*) and size (*parvus*).

Geron ablusus spec. nov. fig. 23.

♀. *Body* black; genae pale ivory yellowish, katepimeron and sides of first abdominal segment extensively light yellowish red, posterior margins of first three tergites narrowly light brownish, base of venter extensively brownish; with extensive and heavy dusting, mostly grey, including a broad median mesothoracic stripe extending as far as the suture and flanked by broad areas of brown dusting. *Head* with frons less than twice width of ocellar tubercle and at antennae only about 1½ times width at vertex; antennal proportions 3:1:7. *Pubescence* white, generally with a pale sericeous yellow sheen, especially the stout occipital hair and that on abdomen, scales with a silvery sheen but those on dorsum of abdomen pale brassy; facial tuft large and dense. *Legs:* front pair dark blackish brown, the apical tarsal segments black, base of tibia somewhat paler brown; other legs with femora blackish brown for basal three quarters or so, hind pair slightly the paler, the apices yellowish brown, tibiae yellowish, basitarsi yellowish brown basally, tarsi thence darkening to black; pubescence slightly yellowish on front femora, otherwise white, spicules black; claws black, light brownish basally. *Wing* (fig. 23) vitreous with very slight milky tinge; veins slightly brownish appically, s–m beyond middle of discal cell, S3 rising steeply from S4, curved forward and joining costa well before wing apex, penultimate section of S4 twice as long as last section.

Length of body 4,1 mm, of wing 4,6 mm.

MATERIAL EXAMINED: 1 ♀, holotype, S. NIGERIA, 1908, G. C. Dudgeon. In British Museum (Natural History).

This is the specimen referred to by Hesse (1938, 872) as mistakenly identified as *hybridus* Mg. (= *gibbosus* Oliv.). It is very similar to *samarus* but is easily distinguished by the very much darker front legs.

Geron saccharus spec. nov. fig. 24.

♀. Differing from *samarus* as follows: face dull undusted black without any paler spot or steaks, katepimeron pale yellow, sides of first five abdominal segments only light yellowish, broadly so on first two then narrowing to fifth, second sternite light brownish over posterior half; dark occipital stripes with dense brownish dust, thus appearing dull brown not velvety black, mesonotal medial dusted stripe broader anteriorly and extending as far as wing bases, frontal macula a broad, undusted semi-circle above antennae. *Pubescence* nearly all white, only the stiffer hairs on middle of occiput, front and sides of mesonotum and upper part of mesopleuron with very pale yellowish brassy flush; similarly the mesonotal scales and those on the black, undusted dorsum of

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abdomen with very pale brassy flush. *Legs:* coxae brownish only on articulating surfaces, front femora brownish, yellowish brown at extreme base and apically, front tibiae brownish apically, front metatarsi brown, but yellowish at extreme base, hind metatarsus broadly brownish apically, other tarsal segments brownish black to black. *Wing* (fig. 24) very slightly milky sub-opaque, membrane between Sc and R more distinctly yellowish to stigma, veins more brownish yellow throughout, less noticeably darkened apically; Sc at middle touching R, S2 noteably weak and thin, S3 more broadly undulate; squamae and halteres similar. *Head* with frons at vertex a little less than twice width of ocellar tubercle, widening to only 2½ times at antennae; first antennal segment about twice length of second.

Length of body 4,0 mm, of wing 5,0 mm, of proboscis 3,0 mm.

MATERIAL EXAMINED: 1 ♀, holotype, NIGERIA, Bacita Sugar Estate, nr. Jebba, 19.vi.1966, J. Bowden. In my collection.

This species is part of the *peringueyi* complex, differing from that species in the more extensively yellow katepimeron and base of abdomen, the slight but distinct yellowish tint to the pubescence and the entirely pale mid and hind femora; the wings are also less noticeably milky. From species such as *psammobates*, with distinctly milky wings, *saccharus* is distinguished by the short first antennal segment and narrower frons.

Geron nasutus Bezzi. figs 25–29.

Geron nasutus Bezzi 1924: 114; Hesse 1938: 890.

Bezzi described this species from a single male from Mt. Mlanje, Malawi; this type is now at the British Museum (Natural History), not the South African Museum as stated by Hesse, and has lost its abdomen. Hesse described a solitary female from the north west part of South West Africa and these two specimens are all that have been recorded of *nasutus*, which is very easily recognised by its bare, shining, produced face (fig. 25). With a good series from Nigeria an assessment of its taxonomic position is possible.

It is a large species, ranging up to 8 mm in length, the females being decidedly more yellowish in appearance than the males because of the dense covering of fine, yellowish to golden scales combined with a brownish to ochraceous dusting. Apart from the characteristic face, there are no superficial characters to distinguish *nasutus* from species considered by Hesse to be *Geron* (*sensu stricto*), and in the wing the sectoral fork is short, which was one of the prime characters used by Hesse to separate *Geron* from *Amictogeron:* compare and contrast figs 4 and 26 with the other wings illustrated here. However, the male genitalia (figs 27–29) are very similar to those of *Pseudoamictus*, particularly *heteropterus* Wiedemann. There is a strong, pointed, posteriorly directed process arising from each basimere; these processes are connected to the aedeagal process by lateral rami. The genitalia of *nasutus* differ from those of *heteropterus* and its allies in the short, stout aedeagus, which is more like that of species of *Geron* (*sensu stricto*). The three combs of flattened, scale like hairs immediately distinguish these genitalia from all others described in the genus, although *G. griseus* Zaitsev has an apical pair of small combs on the basimeres.

G. nasutus is quite common in southern Nigeria; at Ibadan it is frequent in March and April. Both sexes can be taken hovering over the flowers of various small Compositae, particularly those of *Tridax procumbens*, when they often show the bobbing

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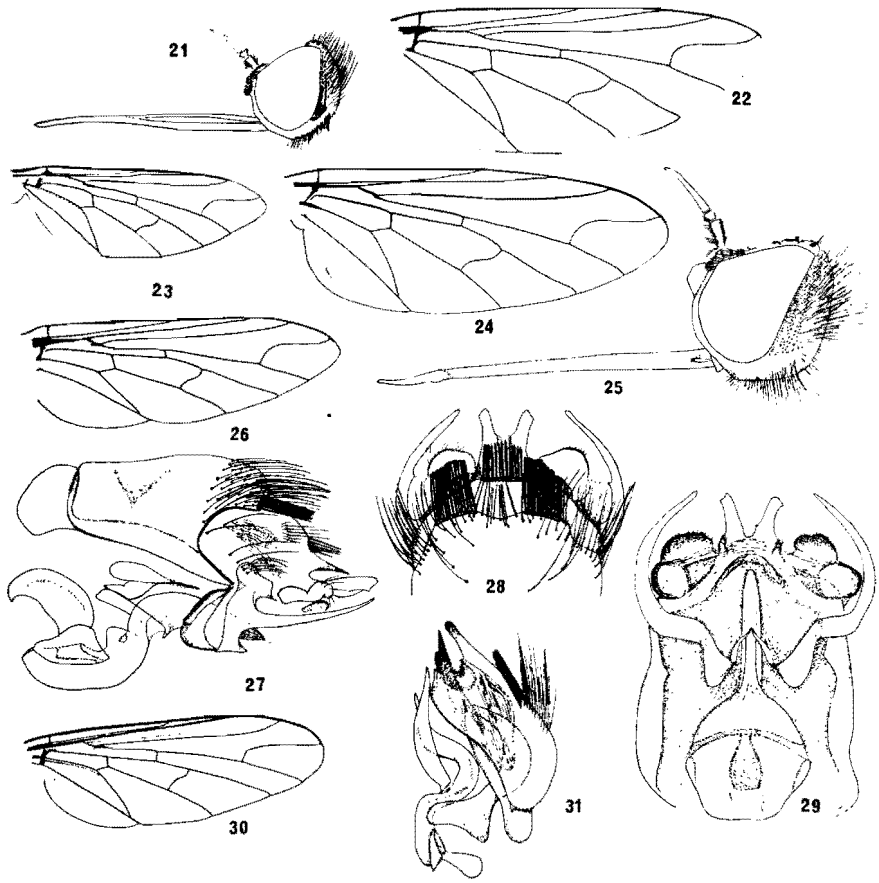

Figs 21–31. *Geron* species. 21–22. *G. samarus* spec. nov. 21. Head. 22. Wing. 23. *G. ablusus* spec. nov.—wing. 24. *G. saccharus* spec. nov.—wing. 25–29. *G. nasutus*. 25. Head. 26. Wing. 27. Male genitalia. 28. Male genitalia, dorsal view of apices of basimeres and telomeres. 29. Male genitalia, ventral view. 30–31. *G. umbripennis*. 30. Wing. 31. Male genitalia.

up-and-down flight characteristic of some species of *Geron* (cf. Painter, 1932). Extremely active and of rapid flight in bright sunshine, both sexes promptly settle on flower heads, occasionally on grass heads, when clouds pass over the sun. During dull weather no individuals are seen, but can sometimes be flushed from the depths of herbaceous vegetation. In addition to Ibadan, *nasutus* has also been taken near Abeokuta, about 50 miles south-west of Ibadan, and Ife, about 50 miles north-east of Ibadan, these localities being moist semi-deciduous forest badly degraded by farming activity, and also at Samaru, near Zaria, in the northern Guinea savanna.

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Geron umbripennis Bezzi. figs 30, 31.

Geron umbripennis Bezzi and Lamb 1926: 543.

This species, described from Rodrigues, is another in which characters overlap two of the "genera". The pubescence is decidedly sparser than in *Geron* (*sensu stricto*) and, on the thorax and abdomen, is black; the greyish or silvery dusting usually found in *Geron* is almost absent; head with black pubescence on frons of female, the genal hairs long and white; in female, vertex at most 1½ times width of ocellar tubercle; first antennal segment very short, only twice length of second segment and with black hairs. Wing (fig. 30) relatively narrow, distinctly brownish infuscate and iridescent, sectoral fork short. These characters would, in the keys of Hesse (1938, 1956) place *umbripennis* in *Amictogeron*, yet the male genitalia (fig. 31) are very similar to species of *Geron* such as *orthoperus* Hesse, being distinguished by the comb of stout, posteriorly directed bristles near the apex of the basimeres. The species is similar in many respects to *semifuscus* Séguy but differs in the wing venation and the black pubescence.

Geron semifuscus Séguy.

Geron semifuscus Séguy 1933: 13, 94; figs 2, 3.
Amictogeron phaeopterus Hesse 1938: 942, fig. 289. **syn. nov.**

The type of *semifuscus* is in the Museum National d'Histoire Naturelle, Paris. It is a female, not a male as stated by Séguy, and the paratype is also female. Hesse (1956) suggested that *semifuscus* could be the same as one of three infuscate winged species which he described in 1938 and examination of the respective types reveals the synonymy given above.

The delicate, dark winged species are, in my view, a natural group, with characters in common which connect *Geron* s.str. with the "typical" species of *Amictogeron* such as *meromelaenus* Hesse, and they also have an interesting distribution. *G. semifuscus* and two other species are found in the south-eastern parts of southern Africa; *umbripennis* in Rodrigues; *opacus* Bowden and *sparsus* Bowden in the Bismarck Islands and *simplex* Walker, from Aru, probably belongs to the group. This distribution is very similar to that of some other groups of species in different families and orders. For example, there is a distinctive group of *Philoliche* Wiedemann (Tabanidae) with species in Mauritius and New Caledonia (Oldroyd, 1962; Mackerras, 1964). *Tabanotelum* Oldroyd (Tabanidae), described from Mauritius, is now considered a subgenus of the eastern *Cydistomyia* Taylor, in which there are New Guinea and western Pacific species which are close to *Tabanotelum* (Mackerras, 1964), and there are two species of *Tabanotelum* in India (Mackerras, 1962). Furthermore, Mackerras (1964) reduces *Amanella* Oldroyd to a subgenus of *Cydistomyia*, which thus puts a group distributed into East Africa into the same genus as Mascarene species. Among the Odonata, to take examples from a quite different order, and one which contains some powerful fliers, Fraser (1949) says that the genus *Hemicordulia* Selys is essentially Papuan, but one species, *H. asiatica* Selys, has spread as far as the Western Ghats of India and to Ceylon. According to Fraser (1950), there are two species for which there is good evidence to show that they are lineal descendants of *H. asiaticus*; of these, *H. virens* (Rambur) is known only from Mauritius and *H. similis* (Rambur) from Madagascar and the Seychelles. The Mauritian species of *Coenagriocnemis* Fraser (*C. rufipes* (Selys) and *C. insulare* (Selys)) present a somewhat different affinity – to South American

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species of *Ischnura* Charpentier, and since *C. reunense* (Fraser) from Reunion is very similar to *insulare*, it presumably has the same affinities.

These relationships are at variance with the widely held view that the Mascarenes are classical Wallacean oceanic islands. I consider them to be a continental fragment of Gondwana. The geological evidence lends support to this hypothesis. The islands are all volcanic; the oldest rocks on Reunion are andesites; the newest, basalts which seem to have been extruded not later than the Pliocene. On Mauritius, the vulcanism can be separated into three periods, the earliest in the Cretaceous, or possibly the early Tertiary, and which was very violent, probably explosive. All three islands are on the same submarine ridge and two associated facts suggest that the Mascarene ridge is a continental fragment. The first fact is Cretaceous vulcanism; the second is the presence of andesite, which is associated with often violent vulcanism along the continental side of oceanic trenches (Tarling and Tarling, 1972). There seem to be only two possibilities; either the Mascarene ridge has been more or less static, or it has moved. If the ridge has been static, then it must inevitably have been in collision with the Afro-India plate as the latter moved northwards. A collision would have resulted in up-thrust mountains, not volcanoes. So the Mascarene ridge has probably moved, from a more south-westerly location in association with parts of Gondwana. The ridge is situated on the western side of the present edge of the African plate, so, presumably, it is part of this plate and has moved with the plate. The vulcanicity would thus be associated either with the fracture along which Africa–Madagascar–India split from north-west Antarctica; or, since there is andesite and evidence for explosive vulcanicity, the ridge represents the old continental–i.e. Gondwanan–side of a subduction trench between the Cretaceous African plate and whatever old plate was being overrun.

The evidence, both zoo-geographical and geological, supports the hypothesis that the Mascarene Islands, like the Canaries and also Kerguelen and Crozet Islands (Jeannel, 1941), are a Gondwanan fragment. Their fauna is a relict Gondwanan fauna; the *semifuscus–umbripennis* group therefore represents an ancient lineage within the genus *Geron*.

REFERENCES

BEZZI, M. 1920. Ditteri racolti da Leonardo Fea durante il suo viaggio nell'Africa occidentale. *Annali Mus. Civ. Stor. nat. Genova*, ser. 3, **9**: 98–114.

———— 1924. *The Bomyliidae of the Ethiopian Region*. London, British Museum (Natural History).

BEZZI, M. & LAMB, C. G. 1926. Diptera (excluding Nematocera) from the island of Rodrigues. *Trans. ent. Soc. Lond.* **(1925)**: 537–573.

BOWDEN, J. 1971. Bombyliidae collected by the Noona Dan Expedition in the Philippine and Bismark Islands (Insecta, Diptera). *Steenstrupia* **1**: 309–322.

———— 1973. Studies in African Bombyliidae. VII. On *Dischistus* Loew and related genera, and *Bombylisoma* Rondani, with some zoogeographical considerations. *J. ent. Soc. sth. Afr.* **36**: 139–158.

DESCAMPS, M. 1956. Insectes nuisibles au riz dans le nord Cameroun. *Agronomia trop.* **11**: 732–755.

DONAHUE, J. P. 1967. *Geron calvus* (Diptera: Bombyliidae) a parasite of *Solenobia walshella* (Lepidoptera: Psychidae) in Michigan. *Michigan Ent.* **1**: 284.

EFFLATOUN, H. C. 1945. A Monograph of Egyptian Diptera. Part VI. Bombyliidae, Section I: Bombyliidae Homoeophthalmae. *Bull. Soc. Fouad 1er Entom.* **29**: 1–482.

Reproduced by Sabinet Gateway under licence granted by the Publisher (dated 2009)

ENGEL, E. O. 1933. Bombyliidae. Fam. 25 in Linder, F., ed. *Die Fliegen der Palaearktischen Region;* lfg. 69. Stuttgart.

FRASER, F. C. 1949. Notes on the Odonata of Mauritius. The genus *Hemicordulia* Selys. *Proc. R. ent. Soc. Lond.* (B) **18:** 130–134.

———— 1950. The Odonata of Mauritius, suborder Anisoptera, and the description of a new species of Zygoptera. *Ibid.* **19:** 70–77.

FREY, R. 1937. Die Dipterenfauna der Kanarischen Inseln und ihre Probleme. *Commentat. biol. Helsingfors*, VI, **1:** 1–737.

HAMILTON, K. G. A. 1971. The Insect Wing. Part I. Origin and development of wings from notal lobes. *J. Kans. ent. Soc.* **44:** 421–433.

———— 1972a. The Insect Wing. Part II. Vein homology and the archetypal insect wing. *ibid.* **45:** 54–58.

———— 1972b. The Insect Wing. Part III. Venation of the orders. *ibid.* **45:** 145–162.

———— 1972c. The Insect Wing. Part IV. Venational trends and the phylogeny of the winged orders. *ibid.* **45:** 295–308.

HESSE, A. J. 1938. A Revision of the Bombyliidae (Diptera) of Southern Africa. Part I. *Ann. S. Afr. Mus.* **34:** 1–1053.

———— 1956. A Revision of the Bombyliidae (Diptera) of Southern Africa. Part III. *ibid.* **35:** 465–972.

JEANNEL, R. 1941. Au seuil de l'Antarctique. *Mus. Nat. d'Hist. Nat., Paris.* Publ. No. **5.** 236 pp.

MACKERRAS, I. M. 1962. On some Oriental and Pacific Tabaninae (Diptera: Tabanidae) *Pacif. Insects* **4:** 101–113.

———— 1964. The Tabanidae (Diptera) of New Guinea. *Ibid.* **6:** 69–210.

MAXWELL-LEFROY, H. 1909. *Indian Insect Life.* London.

MEIGEN, J. W. 1804. *Klass. Beschr. europ. Zweifl. Ins.* Erster Band. Braunschweig.

———— 1920. *Syst. Beschr. europ. Zweifl. Ins.* 2. Aachen.

MIK, J. 1896. Dipterologische miscellen (2 serie). VII. *Wien. ent. Ztg* **15:** 106–114.

MÜHLENBERG, M. 1971. Phylogenetisch systematische Studien an Bombyliiden (Diptera). *Z. Morphol. Okol. Tiere* **70:** 73–102.

OLDROYD, H. 1962. The genus *Philoliche* (Diptera: Tabanidae) in the island of Mauritius. *Proc. R. ent. Soc. Lond.* (B) **31:** 107–108.

OLIVIER, J. 1789. Encyclop. Method., VI.

PAINTER, R. H. 1932. A Monographic Study of the Genus *Geron* Meigen as it occurs in the United States. *Trans. Am. ent. Soc.* **58:** 139–168.

PAINTER, R. H. & PAINTER, E. M. 1965. Bombyliidae, in *Catalog of the Diptera of America north of Mexico.* A. Stone, C. W. Sabrosky, W. W. Wirth, R. H. Foote and J. R. Coulson, Eds. Washington, D.C., Agric. Handbook No. 276, A.R.S., U.S.D.A.

PARAMONOV, S. J. 1929. Beiträge zur Monographie einiger Bombyliiden Gattungen (Diptera). *Trav. Mus. Zool. Kieff* **6:** 1–161.

ROHDENDORF, B. B. 1964. Isroritscheskoje razwitie dwukrylych nasjekomych. *Trudy pal. Inst. Akad. Nauk, U.S.S.R.*, **100:** 1–311.

SÉGUY, E. 1933. Contributions a l'étude de la fauna du Mozambique. Voyage de H. P. Lesne (1928–1929). 13e. note. Diptères (2e partie). *Mém. Mus. Zool. Univ. Coimbra* (1), No. **67:** 5–80.

———— 1959. Introduction a l'étude morphologique de l'aile des Insectes. *Mém. Mus. natn. Hist. nat., Paris* (Serie A. Zoologie), **21:** 1–221.

TAKHTAJAN, A. 1969. *Flowering Plants: Origin and Dispersal.* Translated by C. Jeffrey. Edinburgh. Oliver and Boyd. 310 pp.

TARLING, D. H. & TARLING, M. P. 1972. Continental Drift. Pelican Books, London. 142 pp.

Reproduced by Sabinet Gateway under licence granted by the Publisher (dated 2009)

VIGNON, P. & SÉGUY, E. 1929a. Sur la présence de la nervure médiane haute chez les Diptères. *Comptes Rend. Acad. Sci. Paris*, **188:** 1699–1701.

———— 1929b. Sur la présence, chez les Diptères, de la médian postérieure vraie, et sur la régression que subit la médiane haute chez les Syrphides. *Bull. ent. Soc. France* **(1929):** 226–230.

ZAITSEV, V. F. 1966. *Parasitic flies of the family Bombyliidae (Diptera) in the fauna of Transcaucasia.* Moscow, Publ. Nauka. 375 pp. (In Russian).

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